CLAIMS

1. A method for processing microfeature workpieces, comprising:

   pretreating a surface of a process chamber before beginning a workpiece deposition process in the process chamber, the pretreating comprising contemporaneously introducing a first pretreatment precursor and a second pretreatment precursor to the process chamber to deposit a pretreatment material on the surface of the process chamber, the first pretreatment precursor comprising titanium and the second pretreatment precursor comprising nitrogen;

   terminating introduction of the first pretreatment precursor to the process chamber and terminating introduction of the second pretreatment precursor to the process chamber;

   after terminating the introduction of the first and second pretreatment precursors, positioning a microfeature workpiece in the process chamber; and

   after positioning the microfeature workpiece in the process chamber, depositing a deposition product comprising titanium nitride on a surface of the microfeature workpiece in the workpiece deposition process, the workpiece deposition process comprising alternately introducing a quantity of a first deposition precursor and a quantity of a second deposition precursor to the process chamber, the first deposition precursor comprising titanium and the second deposition precursor comprising nitrogen.

2. The method of claim 1 wherein the first pretreatment precursor and the first deposition precursor comprise the same precursor.

3. The method of claim 1 wherein both the first pretreatment precursor and the first deposition precursor comprise one precursor and both the second pretreatment precursor and the second deposition precursor comprise another precursor.

4. The method of claim 1 wherein a rate of deposition of the pretreatment material is higher than a rate of deposition of the deposition product.

5. The method of claim 1 wherein pretreating the surface further comprises depositing a layer comprising polysilicon on the surface before depositing the pretreatment material on the surface.

6. The method of claim 1 wherein pretreating the surface further comprises, prior to introducing the first and second pretreatment precursors, a) introducing a poly precursor to the process chamber to deposit a layer comprising polysilicon on the surface, then b) terminating introduction of the poly precursor.

7. The method of claim 1 wherein the first pretreatment material comprises titanium and chlorine, the method further comprising introducing a reducing gas to the process chamber after terminating introduction of the first and second pretreatment precursors to the process chamber.

8. The method of claim 1 wherein the first pretreatment precursor comprises titanium and chlorine and the second pretreatment precursor comprises NH_3, the method further comprising introducing the second pretreatment precursor to the process chamber after terminating introduction of the first precursor to the process chamber.

9. The method of claim 1 wherein depositing the deposition product further comprises depositing the deposition product on a surface of the pretreatment material.

10. The method of claim 1 wherein the pretreatment material is deposited on the surface of the process chamber without a microfeature workpiece in the process chamber.

11. The method of claim 1 further comprising cleaning the surface of the process chamber before the depositing the pretreatment material.

12. A method for processing microfeature workpieces, comprising:
cleaning an inner surface of a process chamber;
after the cleaning but prior to depositing material on a first microfeature workpiece, depositing a coating on the cleaned surface of the process chamber by contemporaneously introducing a gaseous first precursor and a gaseous second precursor to the process chamber to deposit a first reaction product at a first deposition rate;
after depositing the coating, positioning the first microfeature workpiece in the process chamber; and
after positioning the first microfeature workpiece, depositing a second reaction product on a surface of the microfeature workpiece at a second rate, which is lower than the first rate, by depositing a precursor layer of the first precursor at least one monolayer thick and exposing the precursor layer to the second precursor to form a nanolayer reaction product.

13. The method of claim 12 wherein the nanolayer reaction product comprises a first nanolayer reaction product, and wherein depositing the second reaction product on the surface of the microfeature workpiece further comprises

depositing a subsequent precursor layer of the first precursor at least one monolayer thick on the nanolayer reaction product and exposing the subsequent precursor layer to the second precursor to form a second nanolayer reaction product on the first nanolayer reaction product.

14. The method of claim 12 wherein the depositing the coating further comprises depositing a layer comprising polysilicon on the cleaned surface prior to depositing the first reaction product.

15. The method of claim 12 further comprising, prior to depositing the first reaction product, introducing a third precursor to the process chamber to deposit a layer comprising polysilicon on the cleaned surface, wherein the first reaction product is deposited on the layer comprising polysilicon.

16. The method of claim 12 wherein the first precursor comprises chlorine, the method further comprising introducing a reducing gas into the process chamber after depositing the coating.

17. The method of claim 12 wherein the first precursor comprises titanium and the second precursor comprises nitrogen.

18. The method of claim 12 wherein the first precursor comprises chlorine and the second precursor comprises hydrogen, the method further comprising introducing the second precursor into the process chamber after terminating introduction of the first precursor to the process chamber.

19. The method of claim 12 wherein the first precursor comprises $TiCl_4$ and the second precursor comprises NH_3.

20. The method of claim 12 wherein depositing the second reaction product further comprises depositing the second reaction product on a surface of the coating.

21. The method of claim 12 wherein the coating is deposited on the cleaned surface of the process chamber without a microfeature workpiece in the process chamber.

22. A microfeature workpiece processing system comprising:

an enclosure defining a process chamber having a surface, the process chamber being adapted to receive a microfeature workpiece;

a gas supply adapted to selectively deliver to the process chamber a) a first pretreatment precursor comprising titanium, b) a second pretreatment precursor comprising nitrogen, c) a first deposition precursor comprising titanium, and d) a second deposition precursor comprising nitrogen; and

a programmable controller operatively coupled to the gas supply, the controller being programmed to:

pretreat the surface of the process chamber in a pretreatment process before beginning a workpiece deposition process in the process chamber, the pretreatment process comprising contemporaneously introducing the first pretreatment precursor and the second pretreatment precursor to the process chamber to deposit a pretreatment material on the surface of the process chamber; and

deposit a deposition product comprising titanium nitride on a surface of a microfeature workpiece in the workpiece deposition process, the workpiece deposition process comprising alternately introducing a quantity of the first deposition precursor and a quantity of the second deposition precursor to the process chamber.

23. The processing system of claim 22 wherein the first pretreatment precursor and the first deposition precursor comprise the same precursor.

24. The processing system of claim 22 wherein both the first pretreatment precursor and the first deposition precursor comprise one precursor and both the second pretreatment precursor and the second deposition precursor comprise another precursor.

25. The processing system of claim 22 wherein the gas supply is further adapted to selectively deliver a poly precursor comprising silicon and the pretreatment process further comprises, prior to introducing the first and second pretreatment precursors, a) introducing the poly precursor to the process chamber to deposit a layer comprising polysilicon on the surface, then b) terminating introduction of the poly precursor.

26. The processing system of claim 22 wherein the first pretreatment material comprises titanium and chlorine and the gas supply is further adapted to selectively deliver a reducing gas and the pretreatment process further comprises:

terminating introduction of the first pretreatment precursor to the process chamber and terminating introduction of the second pretreatment precursor to the process chamber; and, thereafter,

introducing the reducing gas to the process chamber after terminating introduction of the first and second pretreatment precursors to the process chamber.

27. The processing system of claim 22 wherein the first pretreatment precursor comprises titanium and chlorine and the second pretreatment precursor comprises NH_3, the pretreatment process further comprising terminating introduction of the first precursor to the process chamber and introducing the

second pretreatment precursor to the process chamber after terminating introduction of the first precursor.